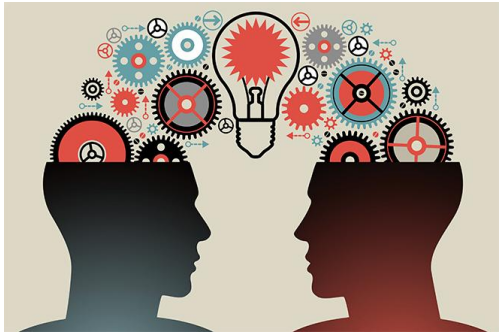
High Impact Teaching Approaches

Iceland 2015

Hawaii 2015

Brain Power and Cognitive Psychology

The biggest strength of a university environment is a massive intellectual power of all faculty.
WE can do a better job if all faculty work together and learn from each other for the greater good of all students.



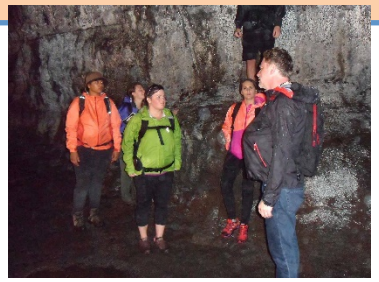
• Impressions from 2016 STEM Education Summit at Boise State University and what the WSU team learned.

- WSU team: 6 participants (2 colleges, 6 departments)
- The summit selected competitively teams from more than 20 universities. The cost mostly covered by the NSF.

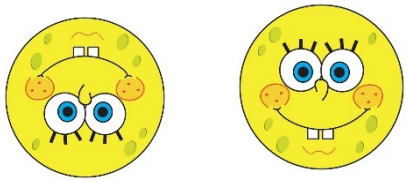
- Main theme: WIDER PERSIST
- **P**romoting **E**ducational **R**eform through **S**trategic **I**nvestments in **S**ystemic **T**ransformation (PERSIST) is a Boise State University project in the National Science Foundation's WIDER Program. WIDER stands for **W**idening **I**mplementation and **D**issemination of **E**vidence-based **R**eforms.

- The ultimate goals of WIDER are to:
- improve student learning
- retention, and
- increase the number of graduates.
- Success requires representatives from all interested departments to provide two-way communication between members of the department and representatives of other departments in order to facilitate rapid and effective communication.
- 90% of surveyed faculty senators and 90% of faculty in the College of Science support this idea.






WORK BUT ALSO FUN



REWARD

- Better efficiency
- Community building
- Brings excitement
- Utilizes better other resources
- Improves retention and graduation
- Helps under-represented students

Outcomes supported by our **vision statement:**

The culture of teaching and learning at (for example: Weber State University will be characterized by:

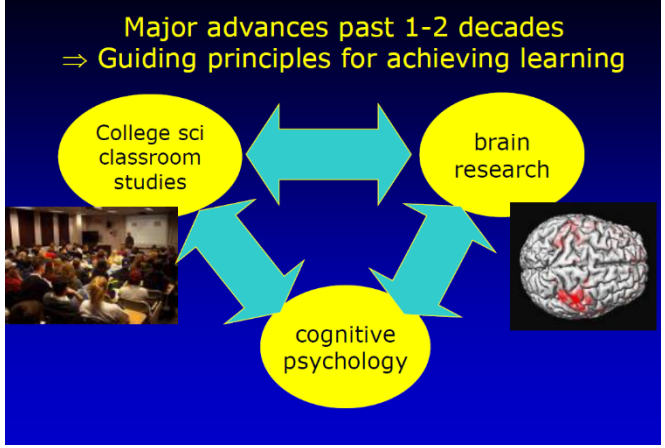
- on-going exploration and adoption of evidence-based instructional practices.
- faculty engaged in continuous improvement of teaching and learning
- dialogue around teaching supported through a community of practice
- teaching evidenced and informed by meaningful assessment

The fulfillment of this vision will enhance our learning-centered culture and will result in increased student achievement of learning outcomes, retention, and degree attainment; especially among underrepresented populations.

Faculty **A**dvocates for **S**TEM **T**ransformation

- The *FAST* Team is a group of faculty who work to stimulate dialogue in their respective departments about evidence-based teaching, and who act as community leaders and points of contact for teaching and learning resources.
- Each FAST Team member is working within their department to promote dialogue about teaching and learning through various activities.

FAST Team members meet twice per month to discuss their experiences, share best practices, and develop resources and report back to their departments.



EBIPs (Evidence Based Instruction Practices) are generally linked to evidence of how people learn.

1.Prior knowledge influences current and future learning

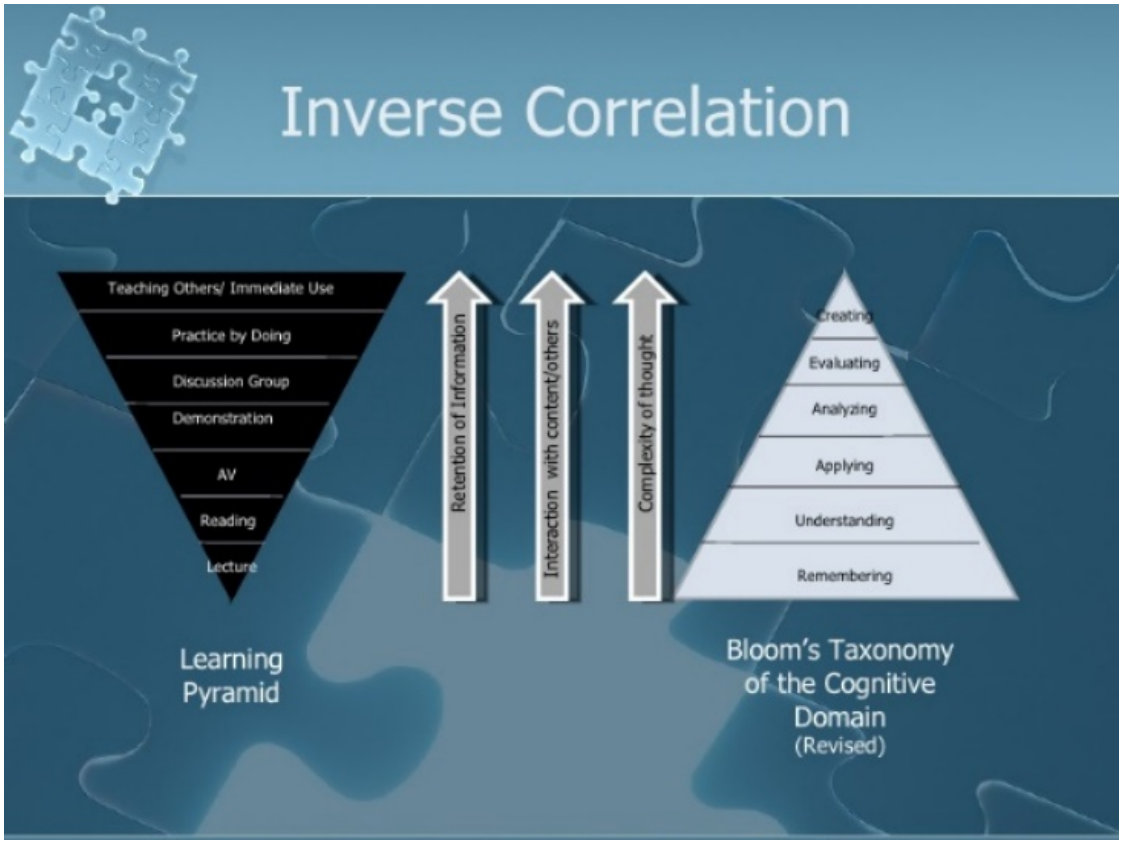
2.How students organize knowledge

3.Motivation

4.Goal directed practice coupled with targeted feedback

6.Emotional, social, and intellectual relationships

7.Metacognitive monitoring of learning



Taking a scientific approach to Science education*

Carl Wieman
Stanford University
Department of Physics and Grad School of Education

example of what is achievable with scientific approach

Learning in class. Two nearly identical 250 student sections intro physics—**same learning objectives, same class time, same test** (right after 3 lectures).

Experienced highly rated traditional lecturer

versus

New physics Ph.D. trained in scientific principles and methods of effective teaching

Education approach I used for many years

think hard, figure out subject

tell students how to understand it

give problem to solve

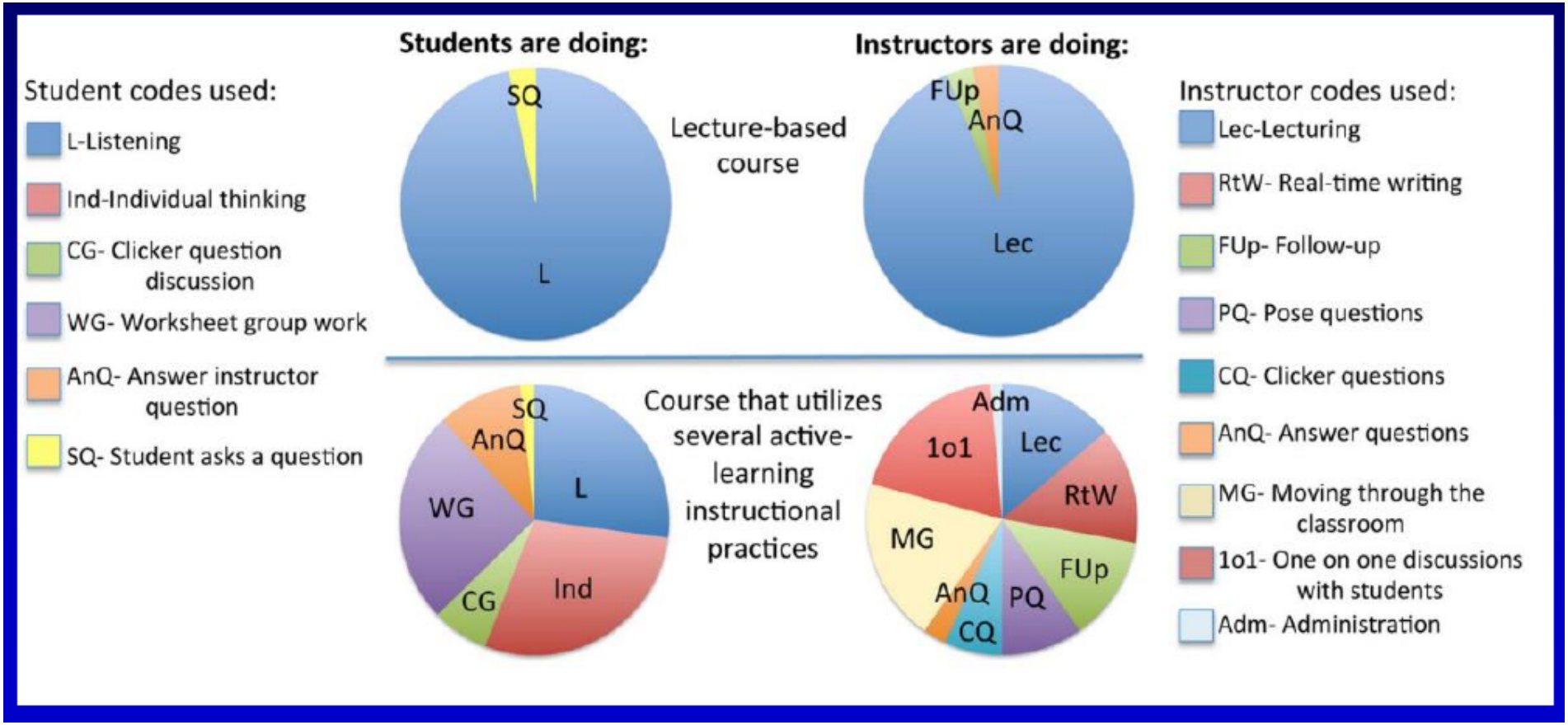
yes

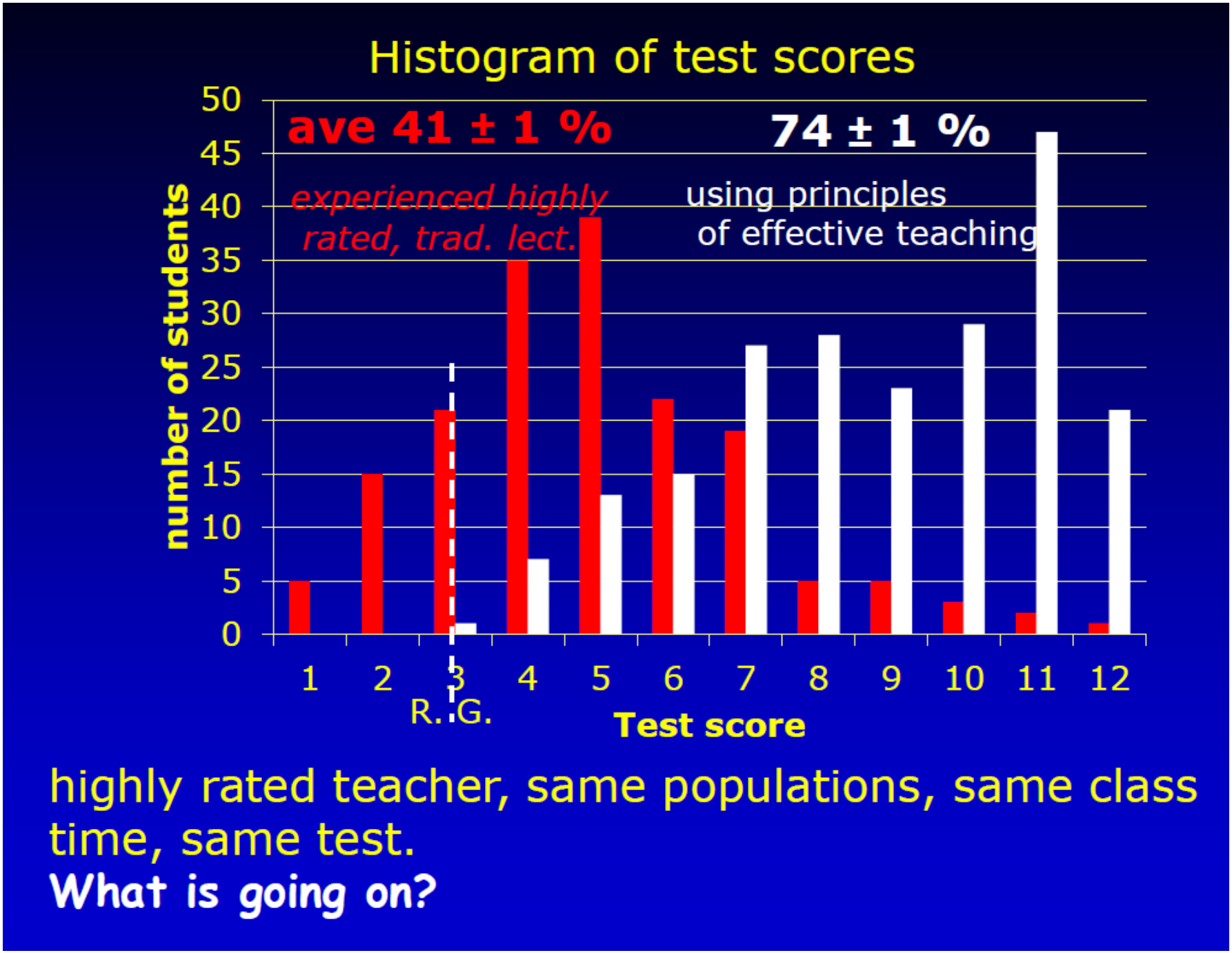
done

no

students lazy or poorly prepared

tell again
Louder


Student codes used:
L-Listening
Ind-Individual thinking
CG- Clicker question discussion
WG- Worksheet group work
AnQ- Answer instructor question
SQ- Student asks a question
Students are doing:
SQ
L
Lecture-based course
Instructors are doing:
FUp
AnQ
Lec
Instructor codes used:
Lec-Lecturing
RtW- Real-time writing
FUp- Follow-up
PQ- Pose questions
CQ- Clicker questions
AnQ- Answer questions
MG- Moving through the classroom
1o1- One on one discussions with students
Adm- Administration
SQ
AnQ
L
WG
CG
Ind
Course that utilizes several active-learning instructional practices
Adm
1o1
Lec
RtW
MG
FUp
AnQ
PQ
CQ



highly rated teacher, same populations, same class time, same test.

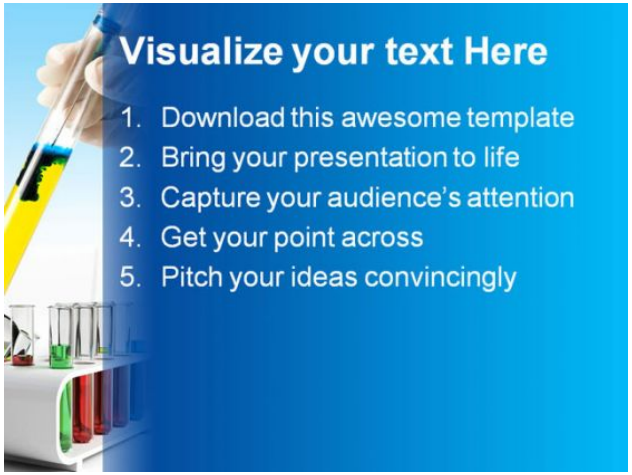
What is going on?

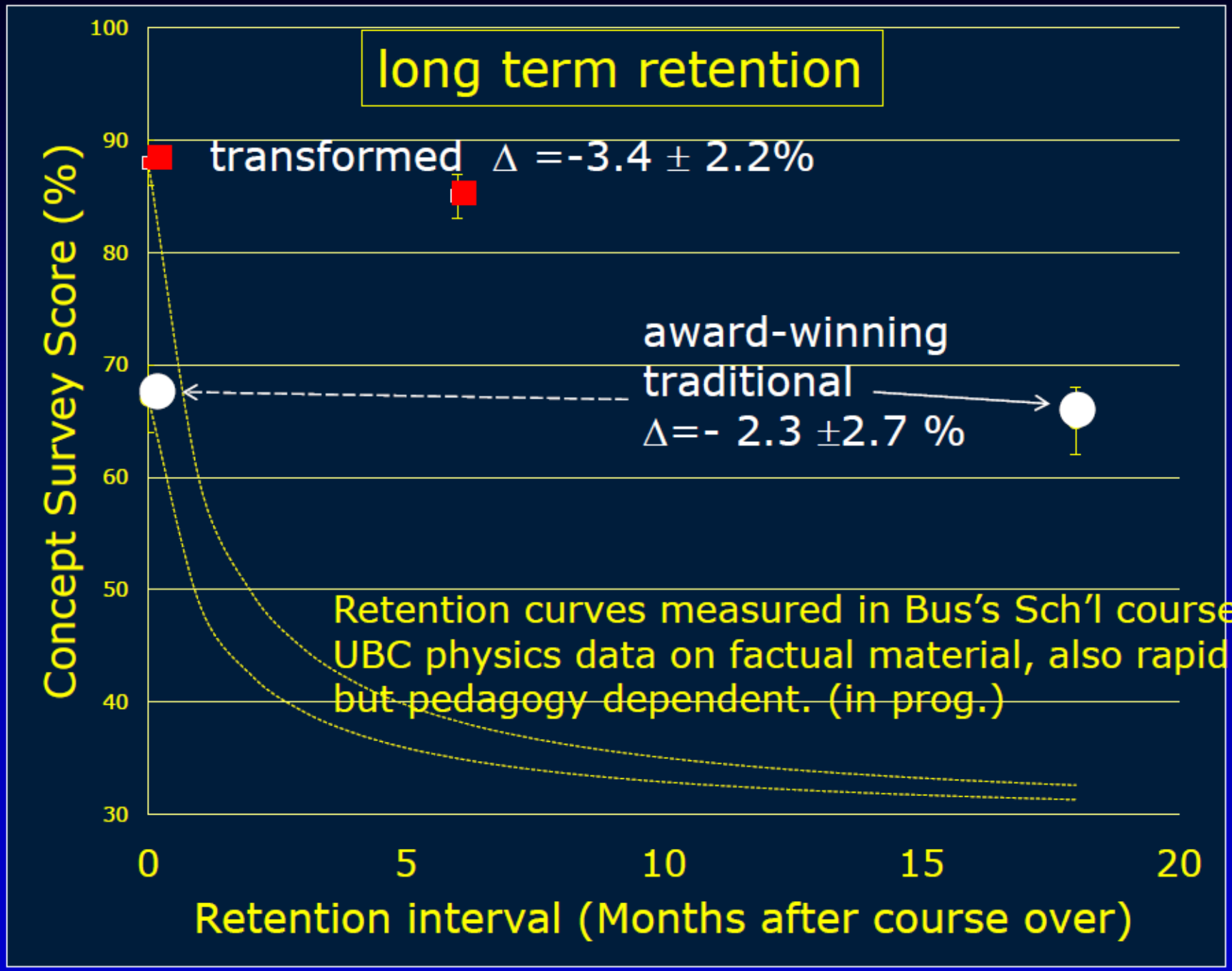
LOCAL EXAMPLES

How much water flows and in which direction? Why? Testing pre-existing knowledge.

Students have roles: implementation is unique.

Group Activity followed by Individual Presentations. Students can use only 5 slides. Goal: organize knowledge, motivation, targeted feedback,




long term retention
transformed Δ =-3.4 ± 2.2%
award-winning
traditional
Δ=- 2.3 ±2.7 %
Retention curves measured in Bus's Sch'l course.
UBC physics data on factual material, also rapid drop
but pedagogy dependent. (in prog.)
Concept Survey Score (%)
100
90
80
70
60
50
40
30
0
5
10
15
20
Retention interval (Months after course over)

How to Better Retain Information

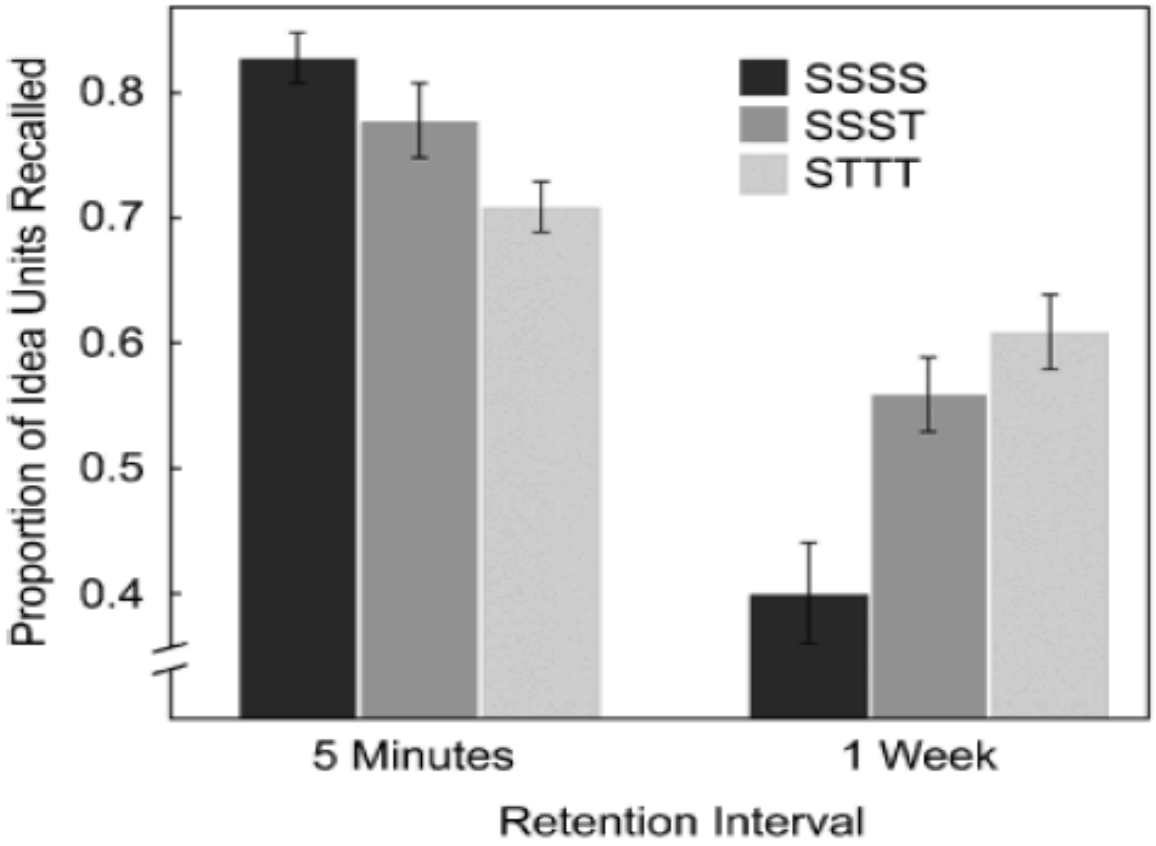
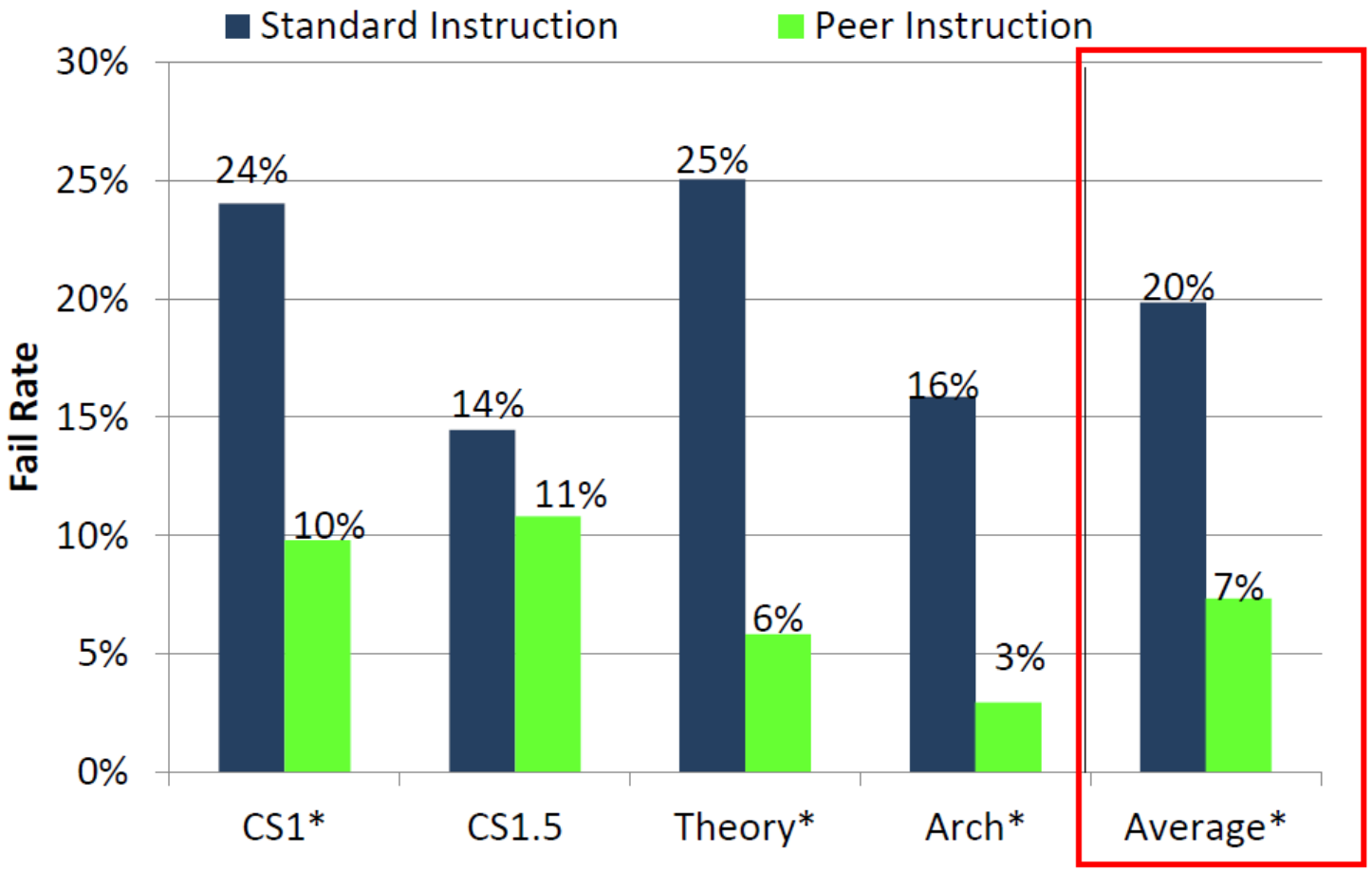


Fig. 2. Mean proportion of idea units recalled on the final test after a 5-min or 1-week retention interval as a function of learning condition (SSSS, SSST, or STTT) in Experiment 2. The labels for the learning conditions indicate the order of study (S) and test (T) periods. Error bars represent standard errors of the means.

Lower Failure Rate

U. Cal. San Diego, Computer Science
Failure & drop rates– *Beth Simon et al., 2012*



same instructors, better methods = 1/3 fail rate

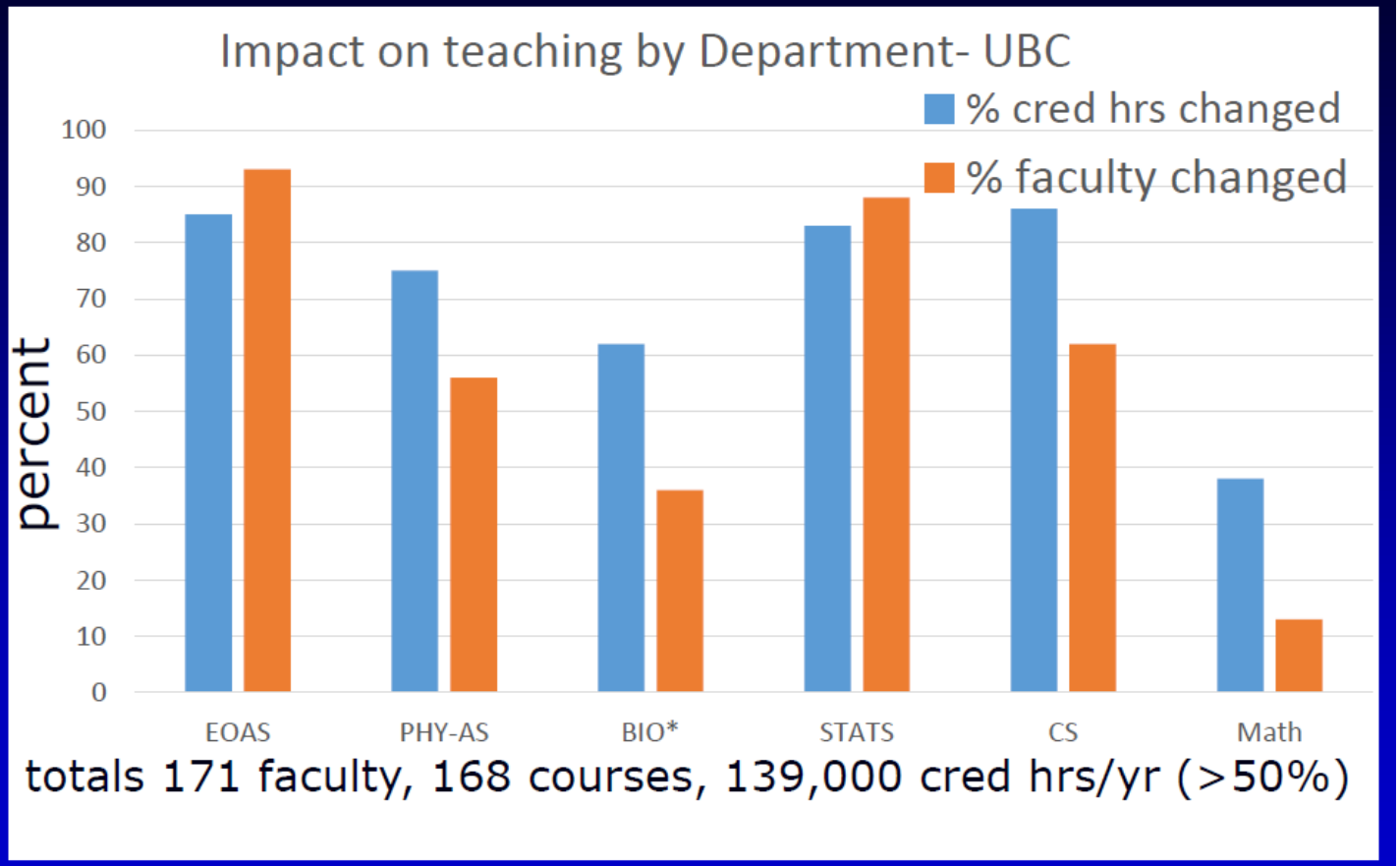
The Science Education Initiatives; results and lessons learned

Carl Wieman Science Education Initiative at the University of British Columbia 2005-12...

The Science Education Initiative at the University of Colorado 2007-14...

There is no correlation between student teaching evaluations and achieved learning outcomes!!!

SEI-- Is Institutional Change. Entire departments.



Colorado– 112 faculty, 53,000 cred hrs/yr, 71 courses. 7-75%/dept.